

**ASTORIA TURNING BASIN
&
FEDERAL NAVIGATION CHANNEL CRM 10-13.5

SEDIMENT QUALITY EVALUATION
REPORT**



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ACRONYMS

EPA	Environmental Protection Agency
USACE	U.S. Army Corps of Engineers
USFWS	U. S. Fish & Wildlife Service
NOAA	National Oceanic & Atmospheric Administration
SquiRT	Screening Quick Reference Tables (NOAA Reference Tables)
WDOE	Washington Department of Ecology
ODEQ	Oregon Department of Environmental Quality
WDNR	Washington Department of Natural Resources
DMEF	Dredge Material Evaluation Framework
CRM	Columbia River Mile
CRCI	Columbia River Channel Improvement (formerly, Columbia River Channel Deepening)
NPL	National Priority List
Superfund	An EPA-NPL contaminated site, scheduled for cleanup.
DQO	Data Quality Objectives
NES	Newly Exposed Surface
QA/QC	Quality Assurance/Quality Control
MDL	Method Detection Limit
CoC	Contaminate of concern
TEL	Threshold Effects Level
PWT	Pacific Wood Treating
TOC	Total Organic Carbon
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
MRL	Method Reporting Limit
TVS	Total Volatile Solids
PCP	Pentachlorophenol
PWT	Pacific Wood Treatment
MTCA	(Washington State) Model Toxics Control Act
TEF	Toxicity Equivalent Factor
TEQ	Toxicity Equivalent Quotient
ND	non-detect
pptr	parts per trillion – ng/kg
As	Arsenic
Cd	Cadmium
Ni	Nickel
Cu	Copper
Sb	Thallium
Cr	Chromium
Pb	Lead
Hg	Mercury
Ni	Nickel
Ag	Silver
Zn	Zinc

Table of Contents

Abstract	1
Introduction	1
Sampling and Analysis Objectives	2
Previous Studies	2
Current Sampling Event/Discussion	2
Results	3
Physical and Volatile Solids (ASTM methods)	3
Metals (EPA method 6020/7471), Total Organic Carbon (EPA method 9060)	3
Pesticides/PCBs (EPA method 8081A/8082), Phenols, Phthalates and Miscellaneous Extractables (EPA method 8270)	4
Tributyltin [Total (Bulk) & Pore-Water]	4
Polynuclear Aromatic Hydrocarbons (EPA method 8270C)	4
Dioxins/Furans (Method SW846 8290)	4
Conclusion	4
References	6
 Table 1. Sample Location Coordinates	3
 Table 2: Physical Analysis and Volatile Solids	7
 Table 3: Inorganic Metals and TOC	8
 Table 4: Pesticides, PCBs, Phenols, Phthalates & Misc. Extractables	9
 Table 5: Total and Pore-water Organotin	10
 Table 6: Polynuclear Aromatic Hydrocarbons (PAHs) Low Molecular Weight Analytes	11
 Table 6 (cont'd): Polynuclear Aromatic Hydrocarbons (PAHs) High Molecular Weight Analytes	12
 Table 7: Dioxins/Furans (ng/kg, pptr)	13
 Table 7 (Cont'd): Dioxins/Furans (ng/kg, pptr)	14
 Table 7 (Cont'd): Dioxins/Furans (ng/kg, pptr)	15
 Figure 1, Astoria Turning Basin & Federal Channel, CRM 10-13.5, Vicinity Map	16
 Figure 2: Astoria Turning Basin & Federal Channel, CRM 10-13.5, Sediment Sampling Station Locations	17

ASTORIA TURNING BASIN & FEDERAL NAVIGATION CHANNEL CRM 10-13.5 SEDIMENT QUALITY EVALUATION REPORT

ABSTRACT

The project includes the Astoria Turning Basin and Columbia River Federal Channel river mile (RM) 10-13.5 located in Clatsop County Oregon (see figure 1). The Turning Basin, which is dredged as part of the federal project at Astoria, includes the area adjacent to the east side of Young's Bay, between the Port Terminals and the Federal Channel. The purpose of this sampling event is to characterize the Turning Basin sediments, which will be dredged as a part of the Columbia River Channel Improvement (CRCI) project, to a depth of 48 feet MLLW (43' channel with 5' advanced maintenance), removing approximately 90,000 CYs. This sampling event is, also, re-sampling Columbia River Mile (CRM) 10-13.5, because samples, CR-BC-05, 06 & 07, were mistakenly collected outside the Federal Project in the 1997 CRCIP sediment characterization event.

This evaluation was conducted following procedures set forth in the Ocean Testing Manual and Inland Testing Manual, developed jointly by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency to assess dredged material. Guidelines used are those developed to implement the Clean Water Act and Marine Protection, Research and Sanctuaries Act. These national guidelines and associated local screening levels are those adopted for use in the regional Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF), November 1998.

A total of fifteen (15) sediment samples, from thirteen (13) sampling stations, were collected along the length of Astoria Turning Basin and the Federal Navigational Channel of the Columbia River, river mile (CRM) 10 – 13.5, on June 25, 2003 (see figure 2). All samples were submitted for physical analyses including total volatile solids and were, also, analyzed for metals (9 inorganic), total organic carbon, pesticides and polychlorinated biphenyls, phenols, phthalates, miscellaneous extractables and polynuclear aromatic hydrocarbon, with three (3) samples selected for dioxin/furan analyses.

The physical analyses resulted in mean values of 1.6% gravel (0%-13.06% range), 85.2% sand (21.14%-100% range), and 13.2% silt/clay (0%-78.86% range), with 2.13% volatile solids (0.45%-6.22% range).

The chemical analyses indicated only very low levels of contamination in any of the samples, with all levels well below their respective DMEF SLs.

Sediment represented by all samples in this sampling event are determined to be suitable for unconfined, in-water placement without further characterization.

INTRODUCTION

The sampling and analysis objectives are stated in the Sampling and Analysis Plan (SAP June 2003), and are, also, listed below. This report will characterize the sediment to be dredged, at the Astoria Turning Basin and Federal Navigational Channel CRM 10-13.5 and outline the procedures used to accomplish these objectives.

ASTORIA TURNING BASIN & FEDERAL NAVIGATION CHANNEL CRM 10-13.5 SEDIMENT QUALITY EVALUATION REPORT

Sampling and Analysis Objectives

Characterize sediments in accordance with the regional dredge material-testing manual, the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF).

- If the vibra-core sampler is able to penetrate beyond the dredging prism, the sample portion representing the newly exposed surface (NES) after dredging will be archived for possible future analysis, if dredging prism analyses exceed DEMF screening levels (SLs). If the vibra-core sampler is not able to penetrate dredging prism, shorter cores will be considered adequate for characterization, if core is homogeneous.
- Collect, handle and analyze representative sediment of the purposed dredging prism, in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.
- Characterize sediments to be dredged for evaluation of environmental impact.
- Conduct physical and chemical characterization only, for this sediment evaluation, unless further characterization is required.

PREVIOUS STUDIES

No historical sampling data was found from inside the turning basin. Two (2) boxcore samples (CR-BC-07 & 08) were collected just outside the turning basin, as part of the sediment characterization conducted in 1997, for potential CRCIP dredging. Sample 07 was submitted for physical and chemical analyses and 08 for physical only. Sample 08 contained no fines (<230 sieve) and only 0.5% volatile solids, reflecting typical Columbia River channel material. Sample 07 analyses indicated 59.1% fines (<230 sieve) and 4.0% volatile solids. The chemical analyses of the 07 sample, do not exceed the DMEF screening levels, but do show higher levels of contaminants of concern than channel sediments. The CR-BC-07 sample was mistakenly collected outside the Federal Project in 1997. Additional samples are being collected near the 07 sampling location, within the Federal Authorized Project, as part of the current sampling event.

CURRENT SAMPLING EVENT/DISCUSSION

A total of fifteen (15) sediment samples, from thirteen (13) sampling stations, were collected along the length of Astoria Turning Basin and the Federal Navigational Channel of the Columbia River, river mile (CRM) 10 – 13.5, on June 25, 2003. Eleven (11) boxcore (BC) samples were taken along with five (5) vibra-core (VC) samples (see figure 2). All samples were submitted for physical analyses including total volatile solids and were, also, analyzed for metals (9 inorganic), total organic carbon, pesticides, polychlorinated biphenyls, phenols, phthalates, miscellaneous extractables and polynuclear aromatic hydrocarbon, with three (3) samples selected for dioxin/furan analyses.

Two (2) samples, ASTB-BC-01 & 09, were both split in the field and submitted for 2 analyses each, with the fine-grained component labeled with an “A” and the coarse component with a “B”. Each of

ASTORIA TURNING BASIN & FEDERAL NAVIGATION CHANNEL CRM 10-13.5 SEDIMENT QUALITY EVALUATION REPORT

these surface grab samples contained a distinct fine-grained component that differed from the typical medium to coarse-grained sand characteristic of the other samples collected in this area. The ASTB-BC-01 sample had a 3" layer of fine-grained material on top of coarser material. The 09 sample contained several mud clasts (1"x1"x2" & 2"x2"x4") on the surface of the sample. These fine-grained split samples contained 70.6% and 78.9% fine-grained material, respectively.

Vibra-core sample recovery lengths were as follows: ASTB-VC-01=43", ASTB-VC-02=60", ASTB-VC-03=70", ASTB-VC-04=36".

**Table 1. Sample Location Coordinates
(NAD 83, Oregon State Plane North)**

ASTB-BC-01	46°11'29.9"	ASTB-BC-02	46°11'28.2"
	123°51'22.2"		123°51'51.5"
ASTB-BC-03	46°11'24.5"	ASTB-BC-04	46°11'27.4"
	123°52'03.9"		123°52'08.3"
ASTB-BC-05	46°11'30.0"	ASTB-BC-06	46°11'28.4"
	123°52'16.4"		123°53'07.3"
ASTB-BC-07	46°11'23.4"	ASTB-BC-08	46°11'27.0"
	123°54'13.6"		123°54'44.7"
ASTB-BC-09	46°11'39.6"	ASTB-VC-01	46°11'23.5"
	123°55'16.9"		123°51'53.7"
ASTB-VC-02	46°11'24.7"	ASTB-VC-03	46°11'26.7"
	123°51'46.6"		123°51'41.9"
ASTB-VC-04	46°11'28.8"		
	123°51'33.1"		

The samples were collected using a vibra-core sampling device (VC) and box-core sampling device (BC). All samples were submitted for physical analyses including total volatile solids (TVS) and were analyzed for metals (9 inorganic), total organic carbon (TOC), pesticides and polychlorinated biphenyls (PCBs), phenols, phthalates, miscellaneous extractables, polynuclear aromatic hydrocarbons (PAHs), organotin (TBT), and dioxin/furan.

RESULTS

Physical and Volatile Solids (ASTM methods)

Fifteen (15) samples and one (1) duplicate sample were submitted for physical and TVS analyses and data are presented in Table 2. Twelve (12) samples were classified as "poorly graded sand," one sample was classified as "poorly graded sand with silt," and one sample was classified as "clean clay with sand." Mean grain size for all the samples is 0.31 mm, with 1.56% gravel, 85.2% sand, and 13.2% fines. Volatile solids for all samples ranged from 0.45% to 6.22%.

Metals (EPA method 6020/7471), Total Organic Carbon (EPA method 9060)

Fifteen (15) samples were submitted for testing, with data presented in Table 3. The TOC ranged from 680 to 21,500 mg/kg in the samples.

ASTORIA TURNING BASIN & FEDERAL NAVIGATION CHANNEL CRM 10-13.5 SEDIMENT QUALITY EVALUATION REPORT

Low levels of most metals tested were found, but no levels approach their respective DMEF SL.

Pesticides/PCBs (EPA method 8081A/8082), Phenols, Phthalates and Miscellaneous Extractables (EPA method 8270)

Fifteen (15) samples were tested for pesticides/PCBs, with data presented in Table 4. No PCBs were found at the MDL in any of the samples. No pesticides (including DDT) were detected in any of the samples. Phthalate compounds were detected in all samples except ASTB-BC-05 and ASTB-BC-09B. The values were well below their respective SLs. Low-level contamination was present in the method blank for Di-n-octylphthalate and Butylbenzylphthalate. Phenols were detected in samples ASTB-BC-01A and ASTB-VC-04, but they were far below their respective DMEF SLs (<0.4% and <3.4% respectively).

Tributyltin [Total (Bulk) & Pore-Water]

Three (3) samples, ASTB-BC-01A, ASTB-BC-09A, ASTB-VC-03, were analyzed for total (bulk) tributyltin, with ASTB-VC-03 analyzed for both total and pore-water tributyltin. The data are presented in Table 5. No tributyltin was detected at low detection levels.

Polynuclear Aromatic Hydrocarbons (EPA method 8270C)

Fifteen (15) samples were tested and the data are presented in Table 6. The “low molecular weight” PAHs were detected in six (6) of the samples. All values were below 1% of their respective SLs. “High molecular weight” PAHs were found in nine (9) samples. All values ranged below 1% of their respective SLs, except those found in sample ASTB-BC-09A. All “high molecular weight” PAHs were found in this sample and their values ranged from 0.7% to 2.7% of their respective SL.

Dioxins/Furans (Method SW846 8290)

Three (3) samples were tested and the data are presented in Table 7. Dioxin (2,3,7,8-TCDD) was not found at the MDL for any of the samples. The total toxic equivalent concentration value for the samples was well below the guidance concentration value.

CONCLUSION

Collection and evaluation of the sediment data was completed using guidelines from the DMEF. The DMEF is a regional manual developed jointly with regional EPA, Corps, Oregon Department of Environmental Quality and Washington Departments of Ecology and Natural Resources. This document is a guideline for implementing the Marine Protection, Research, and Sanctuaries Act and Clean Water Act (40 CFR 230), Section 404 (b)(1). The screening levels used are those adopted for use in the DMEF, final November 1998. The DMEF tiered testing approach requires that material in excess of 20% fines and greater than 5% volatile solids, as well as any material with prior history or is suspected (“reason to believe”) of being contaminated, be subjected to chemical as well as physical analyses.

ASTORIA TURNING BASIN & FEDERAL NAVIGATION CHANNEL CRM 10-13.5 SEDIMENT QUALITY EVALUATION REPORT

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Two (2) samples, ASTB-BC-01 & 09, were both split in the field and submitted for 2 analyses each, with the upper fine-grained component labeled with an “A” and the coarse component with a “B”. Each of these surface grab samples contained a distinct fine-grained component that differed from the typical medium to coarse-grained sand characteristic of the other samples collected in this area. The ASTB-BC-01 sample had a 3” layer of fine-grained material on top of coarser material. The 09 sample contained several mud clasts (1”x1”x2” & 2”x2”x4”) on the surface of the sample in the box-corer. These fine-grained splits samples contained 70.6% and 78.9% fine-grained material, respectively. The ASTB-BC-01 A & B analyses showed little difference in chemical analyses. The ASTB-BC-09 A & B analyses indicated slightly higher PAHs in the fine-grained A fraction, but well below DMEF screening levels.

Even though the vibra-core sampler was not able to penetrate beyond the dredging prism, the sample portion representing the newly exposed surface (NES) after dredging will be considered suitable and the shorter cores will be considered adequate for characterization because cores were homogeneous and the chemical analysis indicated concentrations below DMEF SLs.

The physical analyses resulted in mean values of 1.6% gravel (0%-13.06% range), 85.2% sand (21.14%-100% range), and 13.2% silt/clay (0%-78.86% range), with 2.13% volatile solids (0.45%-6.22% range).

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ASTORIA TURNING BASIN & FEDERAL NAVIGATION CHANNEL CRM 10-13.5 SEDIMENT QUALITY EVALUATION REPORT

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Table 2: Physical Analysis and Volatile Solids
 Sampled June 25, 2003 – Astoria Turning Basin & Federal Channel, CRM 10 – 13.5

Sample I.D.	Grain Size (mm)		Percent			
	Median	Mean	Gravel	Sand	Silt/Clay	Volatile Solids
ASTB-BC-01A	0.035	0.12	1.57	27.83	70.60	6.22
ASTB-BC-01B	0.22	1.06	13.06	71.01	15.93	3.64
ASTB-BC-02	0.61	0.50	2.86	93.53	3.61	0.55
ASTB-BC-03	0.50	0.36	0.00	99.89	0.11	0.45
ASTB-BC-04	0.80	0.55	1.21	97.69	1.09	0.60
ASTB-BC-05	0.30	0.24	0.00	97.96	2.04	0.58
ASTB-BC-06	0.27	0.19	0.00	100.00	0.00	0.51
ASTB-BC-07	0.30	0.22	0.00	98.35	1.65	0.52
ASTB-BC-08	0.20	0.22	0.00	99.42	0.58	0.53
ASTB-BC-09A	0.025	0.05	0.00	21.14	78.86	6.02
ASTB-BC-09B	0.25	0.19	0.00	99.52	0.48	1.10
ASTB-VC-01	0.40	0.43	2.39	95.11	2.50	0.98
ASTB-VC-02	0.20	0.16	0.00	89.88	10.12	2.93
ASTB-VC-03	0.18	0.16	0.61	85.41	13.98	2.26
ASTB-VC-04	0.20	0.26	1.97	97.01	1.02	3.55
ASTB-VC-04 (dup)	0.19	0.21	1.27	90.14	8.59	3.64
Mean	0.29	0.31	1.56	85.2	13.2	2.13
Minimum	0.025	0.05	0.00	21.14	0.00	0.45
Maximum	0.80	1.06	13.06	100	78.86	6.22
ASTB-VC-04 (dup) is a duplicate of ASTB-VC-04.						

Table 3: Inorganic Metals and TOC

Sampled June 25, 2003 – Astoria Turning Basin & Federal Channel, CRM 10 – 13.5

Sample I.D.	As	Cd	Cr	Cu	Pb	Ni	Ag	Zn	Hg	TOC
	mg/kg (ppm)									
ASTB-BC-01A	8.04	<0.664	20.6	36.7	18.5	17.3	<0.664	106	0.105	21500
ASTB-BC-01B	3.64	<0.805	6.79	10.4	5.94	8.54	<0.403	35.2	0.048	20500
ASTB-BC-02	3.53	<0.278	5.54	5.7	4.48	7.87	<0.278	28.8	<0.011	1120
ASTB-BC-03	2.05	<0.323	4.80	4.2	3.98	5.90	<0.323	25.3	<0.012	1070
ASTB-BC-04	3.04	<0.269	4.08	5.37	3.83	5.73	<0.269	26.4	<0.011	685
ASTB-BC-05	1.95	<0.327	6.97	4.59	3.93	8.55	<0.327	28.1	<0.012	680
ASTB-BC-06	1.89	<0.313	5.26	4.58	4.11	7.4	<0.313	27.2	<0.013	729
ASTB-BC-07	1.82	<0.316	5.05	3.96	3.99	6.59	<0.316	21.3	<0.012	875
ASTB-BC-08	2.04	<0.298	6.41	3.98	3.95	7.11	<0.298	22.6	<0.011	980
ASTB-BC-09A	6.95	0.804	21.1	31.2	21.7	15.8	<0.373	121	0.209	15900
ASTB-BC-09B	2.23	<0.291	8.64	7.28	4.39	10.1	<0.291	36.6	0.022 J	5980
ASTB-VC-01	1.87	<0.294	4.95	5.1	3.91	6.47	<0.294	24.2	<0.012	3950
ASTB-VC-02	3.46	<0.331	9.43	10.7	6.12	10.2	<0.331	42.5	0.025	4920
ASTB-VC-03	3.83	<0.346	12.9	19.6	7.83	12.3	<0.346	57	0.045	11500
ASTB-VC-04	3.19	<0.386	11.6	11.3	6.26	11.3	<0.368	50.1	0.028	3400
Screening level (SL)	57	5.1	-	390	450	140	6.1	410	0.41	
J = Estimated value (reported values are above the MDL, but below the PQL). Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit). Symbol (-) = SL not established.										

Table 4: Pesticides, PCBs, Phenols, Phthalates & Misc. Extractables
 Sampled June 25, 2003 – Astoria Turning Basin & Federal Channel, CRM 10 – 13.5

Sample I.D.	Pesticides				Phenol		Phthalates		
	µg/kg (ppb)								
	4,4'-DDD	4,4'-DDE	4,4'-DDT	Total DDT	Phenol	3&4 Methyl phenol	bis(2-Ethylhexyl) phthalate	Butyl benzyl-phthalate	Di-n-butyl phthalate
ASTB-BC-01A	<5.72	<5.72	<5.72	ND	17.2 J	<34	27.9	<21.2	<17
ASTB-BC-01B	<3.26	<3.26	<3.26	ND	<10.2	<20.4	11.5 J	<12.7	20.9 B1
ASTB-BC-02	<2.51	<2.51	<2.51	ND	<7.99	<16	8.1 J	<9.98	16.1 B1
ASTB-BC-03	<2.57	<2.57	<2.57	ND	<7.69	<15.4	<7.69	<9.62	14.8 J B1
ASTB-BC-04	<2.39	<2.39	<2.39	ND	<7.74	<15.5	<7.74	<9.67	11.8 J B1
ASTB-BC-05	<2.62	<2.62	<2.62	ND	<8.61	<17.2	<8.61	<10.8	<8.61
ASTB-BC-06	<2.57	<2.57	<2.57	ND	<8.16	<16.3	11.4 J	<10.2	<8.16
ASTB-BC-07	<2.52	<2.52	<2.52	ND	<8.31	<16.1	<8.31	<10.4	12.1 J B1
ASTB-BC-08	<2.51	<2.51	<2.51	ND	<7.9	<15.8	9.28 J	<9.88	<7.9
ASTB-BC-09A	<3.31	<3.31	<3.31	ND	<10.2	<20.5	10.9 J	<12.8	<10.2
ASTB-BC-09B	<2.63	<2.63	<2.63	ND	<8.33	<16.7	<8.33	<10.4	<8.33
ASTB-VC-01	<2.48	<2.48	<2.48	ND	<7.77	<15.5	<7.77	<9.71	8.13 J B1
ASTB-VC-02	<2.75	<2.75	<2.75	ND	<8.71	<17.4	16.7 J	<10.9	9.69 J B1
ASTB-VC-03	<2.92	<2.92	<2.92	ND	<8.81	<17.6	10.9 J	<11	9.63 J B1
ASTB-VC-04	<3.04	<3.04	<3.04	ND	<9.5	22.3 J	35.2	27 B1	35.6 B1
Screen level (SL)	+	+	+	6.9	420	670	8300	970	5100
J = Estimated value (reported values are above the MDL, but below the PQL). B1 = Low-level contamination was present in the method blank (reported level was < 10 times blank concentration). Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).									

Table 5: Total and Pore-water Organotin

Sampled June 25, 2003 – Astoria Turning Basin & Federal Channel, CRM 10 – 13.5

Sample I.D.	Total (Bulk) Tributyltin ug/kg	Pore-Water Tributyltin Organotin ug/L
DEPS-GC-01	<1.92	-
DEPS-GC-02	<1.21	-
DEPS-GC-03	<1.05	<0.014
Screen level (SL)	73	0.15
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit). Symbol (-) = No sample analyzed.		

Table 6: Polynuclear Aromatic Hydrocarbons (PAHs) Low Molecular Weight Analytes
 Sampled June 25, 2003 – Astoria Turning Basin & Federal Channel, CRM 10 – 13.5

Polynuclear Aromatic Hydrocarbons (PAHs) Low Molecular Weight Analytes µg/kg (ppb)								
Sample I.D.	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	2-Methyl naphthalene	Naphthalene	Phen- anthrene	Total Low PAHs
ASTB-BC-01A	<1.7	<1.7	<1.7	<1.7	<4.25	<1.7	3.25 J	3.3
ASTB-BC-01B	<1.02	1.68 J	1.16J	<1.02	<2.55	<1.02	2.07	4.9
ASTB-BC-02	<0.799	<0.799	<0.799	<0.799	<2	<0.799	<0.799	ND
ASTB-BC-03	<0.769	<0.769	<0.769	<0.769	<1.92	<0.769	<0.769	ND
ASTB-BC-04	<0.774	<0.774	<0.774	<0.774	<1.93	<0.774	<0.774	ND
ASTB-BC-05	<0.861	<0.861	<0.861	<0.861	<2.15	<0.861	<0.861	ND
ASTB-BC-06	<0.816	<0.816	<0.816	<0.816	<2.04	<0.816	<0.816	ND
ASTB-BC-07	<0.831	<0.831	<0.831	<0.831	<2.08	<0.831	<0.831	ND
ASTB-BC-08	<0.79	<0.79	<0.79	<0.79	<1.98	<0.79	<0.79	ND
ASTB-BC-09A	<1.02	3.03	2.48	1.17 J	<2.56	5.25	8.87	20.8
ASTB-BC-09B	<0.833	<0.833	<0.833	<0.833	<2.08	<0.833	<0.833	ND
ASTB-VC-01	<0.777	<0.777	<0.777	<0.777	<1.94	<0.777	<0.777	ND
ASTB-VC-02	<0.871	1.03 J	<0.871	<0.871	<2.18	<0.871	6.21	7.2
ASTB-VC-03	1.04 J	<0.881	0.932 J	0.957 J	<2.2	1.22 J	2.31	6.5
ASTB-VC-04	1.42 J	<0.95	2.49	<0.95	<2.38	3.84 J	7.88	15.6
Screen level (SL)	500	560	960	540	670	2100	1500	5200
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit) J = Estimated value (reported values are above the MDL, but below the PQL).								

Table 6 (cont'd): Polynuclear Aromatic Hydrocarbons (PAHs) High Molecular Weight Analytes
 Sampled June 25, 2003 – Astoria Turning Basin & Federal Channel, CRM 10 – 13.5

Polynuclear Aromatic Hydrocarbons (PAHs) High Molecular Weight Analytes µg/kg (ppb)										
Sample I.D.	Benzo(a)-anthracene	Benzo-fluoro-anthenes	Benzo-(g,h,i)-perylene	Chrysene	Pyrene	Benzo(a)-pyrene	Indeno-(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Fluor-anthene	Total High PAHs
ASTB-BC-01A	5.32	14.7	7.01	7.32	12.4	6.57	4.19 J	<2.23	10.1	67.6
ASTB-BC-01B	7.38	14.9	5.68	11.3	8.66	8.49	4.88	1.54 J	6.96	69.8
ASTB-BC-02	<1.05	<2	<0.799	<0.799	<0.799	<1.05	<1.05	<1.05	<0.799	ND
ASTB-BC-03	<1.01	<1.92	<0.769	<0.769	<0.769	<1.01	<1.01	<1.01	<0.769	ND
ASTB-BC-04	<1.02	<1.93	<0.774	<0.774	0.774	<1.02	<1.02	<1.02	<0.774	0.8
ASTB-BC-05	<1.13	<2.15	<0.861	<0.861	<0.861	<1.13	<1.13	<1.13	<0.861	ND
ASTB-BC-06	<1.07	<2.04	<0.816	<0.816	<0.816	<1.07	<1.07	<1.07	<0.816	ND
ASTB-BC-07	<1.09	<2.08	<0.831	<0.831	<0.831	<1.09	<1.09	<1.09	<0.831	ND
ASTB-BC-08	<1.04	<1.98	<0.79	<0.79	<0.79	<1.04	<1.04	<1.04	<0.79	ND
ASTB-BC-09A	10.1	23.1	18.2	15.3	32.5	19.4	13.6	3.26	21	156.5
ASTB-BC-09B	<1.09	<2.08	<0.833	<0.833	0.857 J	<1.09	<1.09	<1.09	1.33 J	2.2
ASTB-VC-01	<1.02	<1.94	<0.777	<0.777	2.07	<1.02	<1.02	<1.02	2.12	4.2
ASTB-VC-02	2.46	<2.18	4.58	2.9	13.9	3.46	2.76	<1.14	9.75	39.8
ASTB-VC-03	3.63	7.87	4.12	5.09	6.67	3.12	1.44 J	<1.16	6.25	38.2
ASTB-VC-04	4.06	<2.38	4.11	6.37	13.4	6.2	2.09 J	<1.25	14.2	50.4
Screen level (SL)	1300	3200	670	1400	2600	1600	600	230	1700	12000
J = Estimated value (reported values are above the MDL, but below the PQL). Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).										

Table 7: Dioxins/Furans (ng/kg, pptr)

Sampled June 25, 2003 – Astoria Turning Basin & Federal Channel, CRM 10 – 13.5

Sample I.D.	Dioxin/Furan	Result	½ MDL	TEF	TEQ	Guidance*
ASTB-BC-01A - Dioxin ASTB-BC-01A - Furan	2,3,7,8-TCDD	<0.80	<0.40	1.0	0.4	A bulk sediment 2,3,7,8-tetrachlorodibenzo-p-dioxin concentration of 5 ng/kg, or a total toxic equivalent concentration of 15 ng/kg will trigger the requirement to perform bioaccumulation testing.
	1,2,3,7,8-PeCDD	<1.7	<0.85	0.5	0.425	
	1,2,3,4,7,8-HxCDD	<4.3	<2.15	0.1	0.215	
	1,2,3,6,7,8-HxCDD	<4.4	<2.20	0.1	0.22	
	1,2,3,7,8,9-HxCDD	<4.1	<2.05	0.1	0.205	
	1,2,3,4,6,7,8-HpCDD	43		0.01	0.43	
	OCDD	390		0.001	0.390	
	2,3,7,8-TCDF	1.7 CON, J		0.1	0.17	
	1,2,3,7,8-PeCDF	<0.91	<0.46	0.05	0.02275	
	2,3,4,7,8-PeCDF	<0.88	<0.44	0.05	0.022	
	1,2,3,4,7,8-HxCDF	<3.1	<1.55	0.1	0.155	
	1,2,3,6,7,8-HxCDF	<3.0	<1.50	0.1	0.15	
	2,3,4,6,7,8-HxCDF	<3.1	<1.55	0.1	0.155	
	1,2,3,7,8,9-HxCDF	<3.4	<1.70	0.1	0.17	
	1,2,3,4,6,7,8-HpCDF	7.5 J		0.01	0.075	
	1,2,3,4,7,8,9-HpCDF	<1.8	<0.90	0.01	0.009	
	OCDF	15 J		0.001	0.015	
ASTB-BC-01A - Totals	Total TCDF	1.7		0	0	
	Total PeCDF	<0.91	<0.46	0	0	
	Total HxCDF	<3.4	<1.70	0	0	
	Total HpCDF	21		0	0	
	Total TCDD	1.8		0	0	
	Total PeCDD	<1.7	<0.85	0	0	
	Total HxCDD	<5.9	<2.95	0	0	
	Total HpCDD	97		0	0	
Total Dioxins/Furans TEQ					0.44875 ng/kg	<15 ng/kg
J Estimate result. Result is < reporting limit. B Method blank contamination. MDL = Method Detection Limit TEQ = Toxicity Equivalency Quotient TEF = Toxicity Equivalency Factors CON = Confirmation Analysis *Guidance = Puget Sound Dredged Disposal Analysis (PSDDA) Program (Feb 2000) and U.S. EPA Toxicity Equivalency Factors (U.S. EPA 1989; Ahlborg et al. 1994)						

Table 7 (Cont'd): Dioxins/Furans (ng/kg, pptr)

Sampled June 25, 2003 – Astoria Turning Basin & Federal Channel, CRM 10 – 13.

Sample I.D.	Dioxin/Furan	Result	½ MDL	TEF	TEQ	Guidance*
ASTB-BC-09A - Dioxin	2,3,7,8-TCDD	<0.47	<0.235	1.0	0.235	A bulk sediment 2,3,7,8-tetrachlorodibenzo-p-dioxin concentration of 5 ng/kg, or a total toxic equivalent concentration of 15 ng/kg will trigger the requirement to perform bioaccumulation testing.
	1,2,3,7,8-PeCDD	<0.81	<0.405	0.5	0.2025	
	1,2,3,4,7,8-HxCDD	<0.64	<0.32	0.1	0.032	
	1,2,3,6,7,8-HxCDD	<2.6	<1.3	0.1	0.13	
	1,2,3,7,8,9-HxCDD	<1.2	<0.6	0.1	0.06	
	1,2,3,4,6,7,8-HpCDD	63		0.01	0.63	
	OCDD	930		0.001	0.93	
	ASTB-BC-09A - Furan	2.0 CON		0.1	0.2	
	2,3,7,8-TCDF	<0.93	<0.465	0.05	0.02325	
	1,2,3,7,8-PeCDF	<0.95	<0.475	0.05	0.02375	
	2,3,4,7,8-PeCDF	<2.7	<1.35	0.1	0.135	
	1,2,3,4,7,8-HxCDF	<0.80	<0.4	0.1	0.04	
	1,2,3,6,7,8-HxCDF	<0.73	<0.365	0.1	0.0365	
	2,3,4,6,7,8-HxCDF	<0.59	<0.295	0.1	0.0295	
	1,2,3,7,8,9-HxCDF	18		0.01	0.18	
	1,2,3,4,6,7,8-HpCDF	<1.3	<0.65	0.01	0.0065	
ASTB-BC-09A - Totals	OCDF	53		0.001	0.053	
	Total TCDF	3.6		0	0	
	Total PeCDF	<2.5	<1.25	0	0	
	Total HxCDF	16		0	0	
	Total HpCDF	67		0	0	
	Total TCDD	<0.47	<0.235	0	0	
	Total PeCDD	<0.81	<0.405	0	0	
	Total HxCDD	13		0	0	
	Total HpCDD	160		0	0	
Total Dioxins/Furans TEQ					2.947 ng/kg	<15 ng/kg
J Estimate result. Result is < reporting limit. B Method blank contamination. MDL = Method Detection Limit CON= Confirmation Analysis TEQ = Toxicity Equivalency Quotient TEF = Toxicity Equivalency Factors *Guidance = Puget Sound Dredged Disposal Analysis (PSDDA) Program (Feb 2000) and U.S. EPA Toxicity Equivalency Factors (U.S. EPA 1989; Ahlborg et al. 1994)						

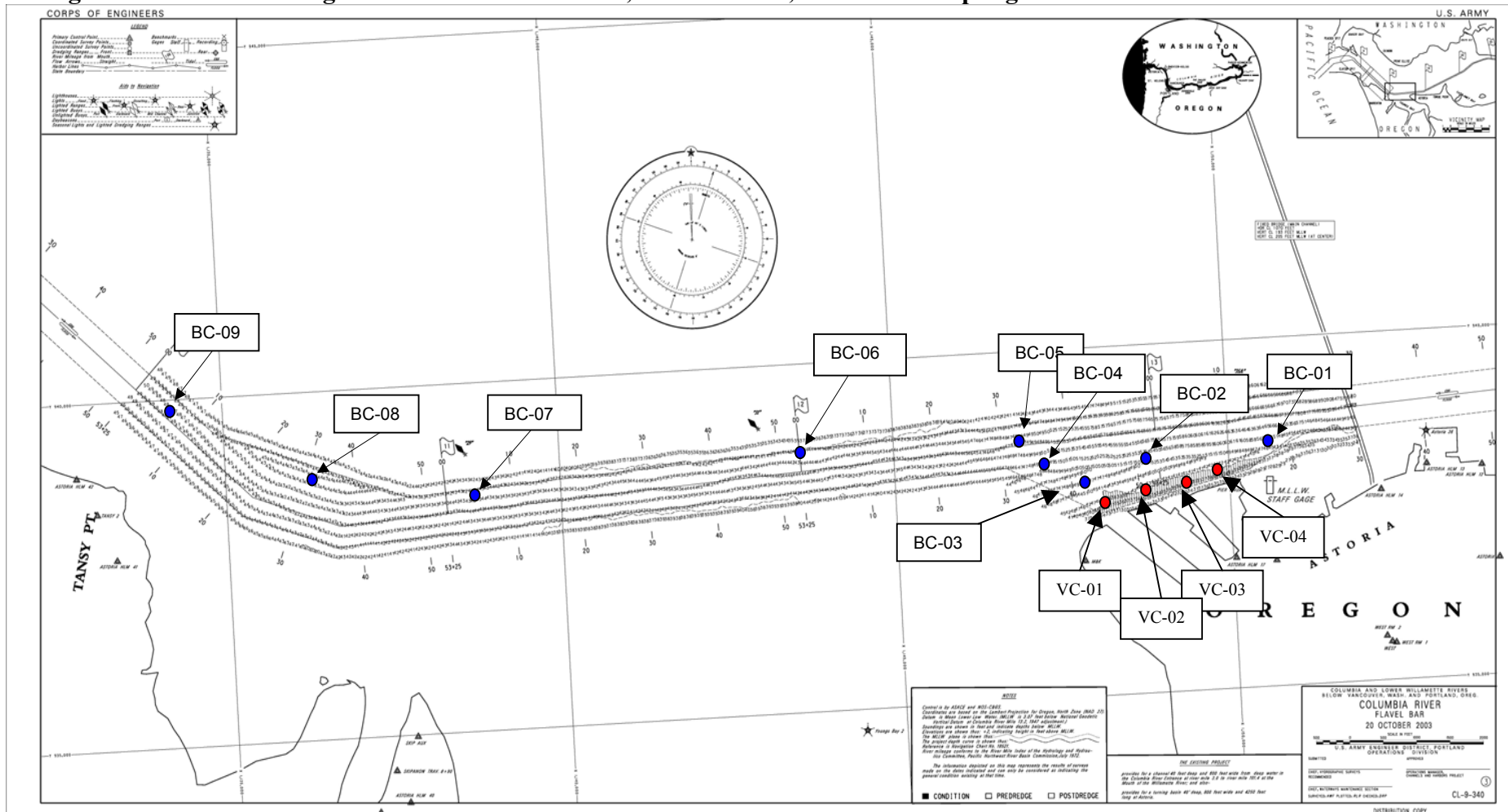
Table 7 (Cont'd): Dioxins/Furans (ng/kg, pptr)

Sampled June 25, 2003 – Astoria Turning Basin & Federal Channel, CRM 10 – 13.5

Sample I.D.	Dioxin/Furan	Result	½ MDL	TEF	TEQ	Guidance*
ASTB-VC-03 - Dioxin ASTB-VC-03 - Furan	2,3,7,8-TCDD	<0.32	<0.16	1.0	0.16	A bulk sediment 2,3,7,8-tetrachlorodibenzo-p-dioxin concentration of 5 ng/kg, or a total toxic equivalent concentration of 15 ng/kg will trigger the requirement to perform bioaccumulation testing.
	1,2,3,7,8-PeCDD	<0.62	<0.31	0.5	0.155	
	1,2,3,4,7,8-HxCDD	<0.64	<0.32	0.1	0.032	
	1,2,3,6,7,8-HxCDD	<0.89	<0.445	0.1	0.0445	
	1,2,3,7,8,9-HxCDD	<0.64	<0.32	0.1	0.032	
	1,2,3,4,6,7,8-HpCDD	15		0.01	0.15	
	OCDD	140		0.001	0.14	
	2,3,7,8-TCDF	0.99 CON, J		0.1	0.099	
	1,2,3,7,8-PeCDF	<0.36	<0.18	0.05	0.009	
	2,3,4,7,8-PeCDF	<0.36	<0.18	0.05	0.009	
	1,2,3,4,7,8-HxCDF	<0.52	<0.26	0.1	0.026	
	1,2,3,6,7,8-HxCDF	<0.52	<0.26	0.1	0.026	
	2,3,4,6,7,8-HxCDF	<0.53	<0.265	0.1	0.0265	
	1,2,3,7,8,9-HxCDF	<0.58	<0.29	0.1	0.029	
	1,2,3,4,6,7,8-HpCDF	4.0 J		0.01	0.04	
	1,2,3,4,7,8,9-HpCDF	<0.67	<0.335	0.01	0.00335	
	OCDF	7.7 J		0.001	0.0077	
ASTB-VC-03 - Totals	Total TCDF	0.99		0	0	
	Total PeCDF	<0.65	<0.325	0	0	
	Total HxCDF	<1.4	<0.7	0	0	
	Total HpCDF	9.9		0	0	
	Total TCDD	<0.52	<0.26	0	0	
	Total PeCDD	<0.62	<0.31	0	0	
	Total HxCDD	5.7		0	0	
	Total HpCDD	37		0	0	
Total Dioxins/Furans TEQ					0.9891 ng/kg	<15 ng/kg
J Estimate result. Result is < reporting limit. B Method blank contamination. MDL = Method Detection Limit CON = Confirmation Analysis TEQ = Toxicity Equivalency Quotient TEF = Toxicity Equivalency Factors *Guidance = Puget Sound Dredged Disposal Analysis (PSDDA) Program (Feb 2000) and U.S. EPA Toxicity Equivalency Factors (U.S. EPA 1989; Ahlborg et al. 1994)						

[illegible]

Figure 2: Astoria Turning Basin & Federal Channel, CRM 10-13.5, Sediment Sampling Station Locations



● VC = Vibra Core Samples – Recovery 01=43”, 02=60”, 03=70”, 04=36”.

● BC = Surface Box Core Samples